USEPA Comments on the March 2, 2015 Draft Rosemont Copper Project Supplemental Information Report – Provided March 18, 2015

Please note that the review time allowed for consideration of this document was relatively brief. EPA's review and comments provided below should not be assumed to include all potential concerns regarding this material, rather, they represent a best effort to provide feedback on a few key issues. Furthermore, these comments are not intended to supplant or supersede any comments made previously on these subjects.

Seep, Springs, and Riparian Areas

Overall comment: A range of model outcomes were assessed for Empire Gulch and Cienega Creek, all of which have high levels of uncertainty due to the long time frames, long distances, and relatively small amounts of drawdown involved. The effect of this uncertainty ripples through the rest of the analysis, resulting in conclusions with regard to probable outcomes that should be viewed as likewise inherently uncertain.

Pg. 37 - Analysis of Baseline Trends, Streamflow:
While some reaches show no statistically significant downward trends in streamflow, the actually trends/values should nevertheless be reported in relation to those reaches with statistically significant changes. If you have some reaches showing statistically significant trends and others that do not but are in the same trending direction, this suggests that the trends may still be biologically relevant. Aquatic organisms respond to real changes in flow and not statistical relationships. The same can be said about the precipitation trends beginning on pg. 35.

Pg. 39 - Wet/Dry Mapping:
Again, the approach downplays the ongoing observed trend in wetted stream length, citing that there is not significant statistical trend. This is misleading and may result in underestimating real impacts to aquatic organisms. For example, while a contracting wetted stream reach may show no significant statistical relationship, a contraction in a small linear distance can still have a large biological effect, especially when the available length of wetted channel is limited during the critical dry season.

Pg. 42:
"The riparian analysis relied on the following basic assumptions:

- *That the flow observed at the USGS stream gage on upper Cienega Creek during the period from 2001 to 2013 (a period of severe drought) was a reasonable representation of flow conditions in the future;*
- *That the cross-section at the gage location was similar in nature to elsewhere along upper Cienega Creek, Empire Gulch, and Gardner Canyon; and*
- *That predicted (i.e., modeled) groundwater drawdown could be superimposed directly on the historic observed stream hydrograph, and that the resulting new hydrograph could then be compared statistically with the historic observed hydrograph."* (emphasis added)

All three assumptions have serious flaws/limitations that may render any conclusions of impacts unreliable or meaningless.

Pg. 46:
"While the topography and effects on the individual pools are analyzed independently, the results are presented as an overall total for each key reach. The reason for this is the long time delay between the current field measurements and the predicted onset of groundwater drawdown from the mine. Impacts along Cienega Creek are not estimated to occur for at least 70 to 75 years after the start of mining.
It is not reasonable to expect that the specific individual pools measured would still exist in their current configuration at that time. ***However, the overall geomorphology of each key reach is assumed to remain similar, since substrate, slope, and bedrock controls would remain similar. In other words, even if the pools change or migrate, the overall number of pools per reach should remain similar****."* (emphasis added)

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This assumption/logic is flawed and may result in underestimating impacts to individual pools within a reach. Changes in surface and groundwater hydrology are known to have effects on sediment transport and bank stability which may result in changes in channel substrate, siltation rates, and morphology. Such changes will likely affect reach specific pool numbers and dimensions. The assumption that the overall number of pools per reach will remain similar over time is likely not true. Rather, it is more likely that the number of pools in each will change over time as surface and groundwater conditions change.

Pg. 46:
"Climate change has been incorporated into the analysis by analyzing trends over the past decade and incorporating additional groundwater drawdown due to expected future changes in temperature. ***Expected changes in precipitation have not been incorporated, since the trend analysis indicates that the hydrographs analyzed already reflect precipitation conditions similar to those expected to be experienced in the future."*** (emphasis added)

This logic seems flawed. Why wouldn't the effects of climate change be additive. The above assumes that the current drought is the result of climate change and not natural drought cycle variation. The FEIS should at least present two scenarios: one with current precipitation trends and another with an additive effect of climate change.

Pg. 47:
"In the FEIS, Gardner Canyon was analyzed as a stream reach. Based on information collected between May and November 2014, it does not appear that Gardner Canyon has perennial flow that supports a core aquatic system similar to those seen on Cienega Creek and Empire Gulch. ***No key reaches were identified on Gardner Canyon during the collaboration."*** (emphasis added)

It is not clear why we would drop Gardner canyon as a key reach because there is no perennial flow. Are we not concerned about effects to riparian systems?

Pg. 47 states:
"In the FEIS, wetland areas adjacent to Cienega Creek were analyzed as part of the overall riparian corridor. The collaboration identified one wetland area of particular importance not only from a biological standpoint, but because of its closer proximity to Empire Gulch and higher levels of predicted mine drawdown, as well as the importance for species reintroductions. ***Cieneguita Wetlands, which are located within the Empire Gulch floodplain upstream from the confluence with Cienega Creek, have been identified as a key reach.***

While we support inclusion of Cieneguita Wetlands in the impact analysis, we question why other wetlands were not included in the analysis.

Pg. 58:
"*The first statistic is commonly known as the P value. The P value can be described as the probability that the linear regression line would occur as calculated, if in reality there is no relationship between the explanatory and the response variables (i.e., the "null hypothesis" is true). In other words, the lower the P-value, the less likely the linear regression line is to have occurred purely by accident.*
Commonly, the P-value is used to determine significance as follows:

- $P \leq 0.01$. *Very strong presumption against null hypothesis.*
- $< P \leq 0.05$. *Strong presumption against null hypothesis.*
- $0.05 < P \leq 0.1$. *Low presumption against null hypothesis.*
- $P > 0.01$. *No presumption against the null hypothesis.*

For the purposes of this analysis, any P value less than or equal to 0.05 is considered statistically significant."

The significance of the P-value is not determined by the test, but by the individual conducting the test. Using various arbitrary ranges of *P* -values to determine statistical significance is acceptable, but they are not

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particularly useful in determining biological significance for purposes of these analyses that are characterized by small sample sizes and conditions where small changes in measured outcomes may result in large, significant biological effects. Therefore, we believe a P-value of ≤ 0.10 is a more appropriate for characterizing a reliable or potentially significant trend. Also, all p-values should be reported as such and not lumped into an arbitrary category. That allows one to ask the important question of "how much of an effect" rather than "if there is an effect."

Experiment-wise error rates are not meaningful, because they are based on the idea of fixing alpa and have meaning only for the hypothetical situation where every null hypothesis being tested is true. The import of a low P value is not so much that it allows you to conclude the null hypothesis is false, but rather it is that a low P value indicates you have a good idea of the sign (-,+) and magnitude of the effect. A high P value means you can't even be sure about the sign of the true effect, let alone of its magnitude. The statistical analysis uses fixed experiment-wise error rates, but there are simply no good reasons to do so. We should be evaluating the gradations and strength of the evidence. There is no sharp dividing line between probable and improbable results.

Pg. 59 – USGS Review of Linear Regression Analysis:

EPA concurs with USGS regarding their caution on the reliance of a single piezometer for the linear regression analysis. Although this is additional information for consideration, we do not believe it is sufficient upon which to draw conclusions. This is especially so given that other variables such as geology, climate and drought are not included in this analysis. EPA is concerned with the use of extrapolation. Whenever a linear regression model is fit to a group of data, the range of the data should be carefully observed. Attempting to use a regression equation to predict values outside of this range is often unreliable, resulting in forecasting error.

Pg. 63 – Climate Change Stress Analysis:

"With respect to precipitation amount, review of the current trends (see appendix B) indicates that during the current ongoing drought, between 2001 and 2014, precipitation has already been in the overall range predicted by climate change (see appendix B, figures B3, B4, and B5). As indicated in the FEIS, one driving factor behind adopting the hydrograph analysis technique used in the FEIS and this SIR is that it incorporates a period of severe drought into future predictions: "The patterns seen in Southern Arizona in the past few decades, and particularly on Cienega Creek, provide a template for what long-term climate change could look like. Prolonged droughts brought on by climate change could result in similar shifts from perennial to intermittent flow along upper Cienega Creek and Empire Gulch" (FEIS, p. 566)."

Please explain why climate change effects are not additive to current temperature and precipitation conditions. The assumption in the SIR is that current conditions are due to climate change and this has not been proven true. The fact that mean annual temperatures do not reflect climate change models suggests that the current drought may be, in part, the result of natural precipitation.

EPA finds that this analysis is highly speculative and therefore predictions based this analysis should be treated with caution.

Pg. 65 - Sources of Uncertainty and the 95th Percentile Analysis

The SIR analysis attempts to condense the modeling scenarios and parameters into a single useful prediction that incorporates all sources of uncertainty. Two factors were incorporated to create a single range that would be expected to represent 95 percent of the possible outcomes. For each key reach, each time step, there are predictions of drawdown from 37 to 38 modeling scenarios. The drawdown from these outcomes was ranked and the 95th percentile range was calculated. In addition, the 95 percent confidence interval was calculated using a linear regression analysis. The SIR states these two factors were then combined to create a single low and single high scenario with 95% of all outcomes falling with the range of these two scenarios.

In addition to the uncertainty of the models, combining different models with different assumptions and

condensing them into a single prediction based on the 95th percentile range is not meaningful. It does not provide greater certainty in predicting the impacts of groundwater drawdown from the mine on surface waters. Furthermore, combining this single outcome with the results of the 95% confidence interval of the linear regression analysis to obtain a single low and single high scenario to explain a range of effects from groundwater drawdown is not meaningful or appropriate.

Pg. 65:
"*The Coronado determined that incorporating additional stresses due to basin growth would be speculative and is not warranted."*

This is a serious analytical shortcoming of the analysis as stresses related to future growth in basin water use may result in additive/cumulative effects that significantly increase the likelihood of adverse effects to aquatic/riparian communities when considered with the effects of mine groundwater drawdown. A range of possible effects from basin stressors should be incorporated into the modeling.

Pg. 66 and Table 12:
"*As previously discussed, there is also statistical uncertainty also in the translation of groundwater drawdown into reductions in stream flow, which was developed using linear regression of available field data. In this case, the 95 percent confidence intervals can be calculated within which we know that 95 percent of the possible regression slopes would fall."*

A number of problematic assumptions regarding the application of the data and of certain statistical analyses of these data bring into question the validity and usefulness of the presented range of results. Therefore, all results should be viewed with caution as they may not reflect actual potential outcomes.

Pg. 83 Seasonal Correction:
"It is recognized that this pool survey was not conducted during the same time of year that is of interest for the presence of refugia pools. Although the pool survey was conducted in November and December during a period that generally is not influenced by runoff, similar to the critical low-flow period in May and June, groundwater levels potentially sustaining the pools during May and June would likely be lower."

This reflects a serious sampling problem. Pool surveys should be conducted during the May-June driest period to verify that the November-December samples are representative when adjusted to the seasonal correction factor.

Pg. 184 - Climate Change.
"*Upper Empire Gulch: The magnitude of potential mine-related impacts is expected to be greatest in Upper Empire Gulch. While climate change would have an impact on stream flow and pool volume, the effects of climate change on the water resources in this area would not substantially add to the effects of the Barrel Alternative due to the magnitude of the potential mine-related impacts. Therefore, no substantial additional impacts to biological resources or species known to occur in DRAFT Rosemont Copper Project Supplemental Information Report – March 2, 2015 185 Empire Gulch Reach 1 (i.e., Chiricahua leopard frog, northern gray hawk, northern beardless tyrannulet, western yellow-billed cuckoo, southwestern willow flycatcher, and Abert's towhee) are expected in this location as a result of climate change.*

Cienega Creek: The mine drawdown alone is expected to have no or little effect on drying of the stream. However, the climate change scenario by itself would have a substantial effect on stream flow and pools, particularly in the downstream reaches of Cienega Creek, where days of zero flow would increase, and though the number pools are not expected to decrease, their volume would. Further, the lower reaches would see greater reductions than higher reaches. Thus, climate change by itself is likely to reduce the habitat extent and quality for aquatic species at Cienega Creek. Impacts to aquatic species occurring here (Huachuca water umbel, Chiricahua leopard frog, lowland leopard frog, northern Mexican gartersnake, longfin dace, Gila chub, and Gila topminnow) are expected to include the loss of habitat, reduction of habitat quality, and increased predation, particularly in lower reaches of Cienega Creek."

If climate change alone is expected to have significant impacts to Cienega Creek aquatic habitats and species, then how can one conclude that climate change would not add substantially to the impacts from the Barrel Alternative at Upper Empire Gulch. This is not logical…the effects of climate change would be additive and therefore significant.

Appendix E. - Linear Regression Analysis for Groundwater Depth Versus Streamflow

Several tables are provided presenting a Summary of the Regression Analysis outputs. With limited information, EPA is unclear on some of the statistical analysis performed. It appears that multiple samples from each experimental unit are taken rather sequentially over several dates. Dates are then taken to represent replicated treatments and significance tests are applied. Treating successive dates as if they are independent replicates of a treatment is invalid. EPA recommends a re-evaluation of the statistical analysis conducted on the groundwater/streamflow data.

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